

## Remarks of the reviewers and answers of the authors:

**Could you please explain what a Belgian tertiary hospital is?**

We use the term 'tertiary' hospital as a synonym for a university hospital. This was adapted in the manuscript (in the abstract as well as in the method's section).

**Did the questionnaire you gave to the physicians also include questions why they decided to send the patients to the ICU or not?**

We agree that this would have been extremely valuable information. However, in order to have a maximum response rate, we used a very short questionnaire asking only objective data on the patient as well as on the DNR code and who participated in the decision to limit therapy.

**How was the decision made for a special DNR-Code? Was this decision mainly based on medical facts (prognosis underlying disease, comorbidity, functionality) or was this an overall decision with the participation of patient family, nurse and physician?**

**Legal aspects in non-communicative patients - is there a legal representative who made the health-care-decisions, or is that done by family members in Belgium?**

Legislation in Belgium demands that physicians inform and ask consent for every medical intervention/decision from the patient – or in case of incapacity from the surrogate decision-maker (this is in practice the nearest family).  
(this was added to the manuscript)

The Order of Physicians in Belgium has added that it is also recommended to involve other members of the healthcare team (nurses!) in the DNR decision-making process.

In this study, we see that 84% of competent patients were at least informed about the decision to limit therapy and that 100% of families of incompetent patients were informed.  
Only in 58%, nurses reported to be involved. (Table 1)

**Adaptations in the manuscript are indicated in yellow.**

# **Factors influencing ICU referral at the end-of-life in the elderly**

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These data were previously published as an abstract entitled ‘Quality of End-of-Life policy: differences between the old and the young?’ on the 5th Congress of the EUGMS · 3-6 September 2008 (European Union Geriatric Medicine Society) in Copenhagen.

# 1    **ABSTRACT**

2    **Objective:** To compare the referral to the Intensive Care Unit (ICU) and frequency of Do-Not-  
3    Resuscitate (DNR) decisions at the end-of-life (EOL) between adult hospitalized patients  $\geq 75$  years  
4    and those  $< 75$  years and to determine influencing factors in the elderly.

5    **Methods:** Data were prospectively collected in all adult patients who deceased during a 12-week  
6    period in 2007 and a 16-week period in 2008 in a tertiary university hospital in Belgium.

7    **Results:** Overall, 330 adult patients died of whom 33% were  $\geq 75$  years old. Patients  $\geq 75$  years old  
8    were less often referred to ICU at EOL (42% vs. 58%,  $p=0.008$ ) and less frequently died in ICU  
9    (31% vs. 46%,  $p=0.012$ ) as compared to patients  $< 75$  years old. However, there was no difference  
10    in frequency of DNR decisions (87% vs. 88%,  $p=0.937$ ) for patients dying on non-ICU wards. After  
11    adjusting for age, gender and the Charlson comorbidity index, being admitted on a geriatric ward  
12    (OR 0.30, 95% CI 0.10-0.85,  $p=0.024$ ) and having an active malignant disease (OR 0.39, 95% CI  
13    0.19-0.78,  $p=0.008$ ) were the only factors associated with a lower risk of dying in ICU.

14    **Conclusion:** Patients  $\geq 75$  years are less often referred to ICU at EOL as compared to patients  $< 75$   
15    years old. However, the risk of dying in ICU was only lower for elderly with cancer and for those  
16    admitted on the geriatric ward.

17

18    **Key words:** DNR decisions; Elderly; End-of-life care; ICU

19

20 **INTRODUCTION**

21 In Western countries many people live to a very advanced age, often with chronic and degenerative  
22 diseases <sup>1,2</sup>. In Flanders, the Dutch-speaking part of Belgium, half of all deaths in a population aged  
23 75 years and older occurs in an acute hospital setting <sup>3</sup> despite the preference to die at home <sup>4,5,6</sup>.  
24 Moreover, palliative care is poor for elderly patients; several studies have found that older patients  
25 receive less pain and symptom control compared to younger patients <sup>7,8,9,10</sup>. To our knowledge, only  
26 one study specifically studied end-of-life (EOL) decisions in an elderly population hospitalized in  
27 an acute care hospital <sup>11</sup>. The authors observed that 54% of very old patients received intensive care  
28 before dying whereas most of these patients had stated that they did not want aggressive care <sup>11</sup>. The  
29 role of the geriatrician in the assessment and management of frail elderly together with EOL care  
30 has recently been described to be important in insuring a good quality of life in the oncogeriatric  
31 patient <sup>12,13,14</sup>.  
32 The objective of this study was to compare the quality of EOL policy between patients in an elderly  
33 population compared to younger people and to determine influencing factors.

34

## 35    **METHODS**

### 36    **Setting**

37    The study was conducted in the Ghent University Hospital, a Belgian ~~tertiary~~ university hospital of  
38    1062 beds with all medical and surgical disciplines present, including organ and bone marrow  
39    transplantation and major oncological surgery. There is a closed Intensive Care Unit (ICU)  
40    department containing 54 ICU beds admitting both surgical and medical patients.

41    Throughout the hospital, a standardized Do-Not-Resuscitate (DNR) form is used on which fixed  
42    categories of non-treatment decisions can be registered. A DNR code 0 means full therapy, DNR  
43    code 1 stands for no cardiopulmonary resuscitation only. DNR code 2 is withholding of therapy (for  
44    example referral to the ICU, upgrading of antibiotics, dialysis) and DNR code 3 withdrawal of life-  
45    sustaining therapy. DNR code 4 (withdrawal of mechanical ventilation) is used in case the dying  
46    process has already started. As for all other medical interventions or decisions, the Belgian Law on  
47    Patient's Rights requires informed consent from the patient or his/her surrogate decision-maker (the  
48    family) in case of incapacity.

### 49    **Quality indicators**

50    Because of a lack of universally accepted quality indicators for in-hospital EOL care, quality  
51    indicators were derived from literature evidence <sup>15,16,17,18</sup> and from a multidisciplinary conference  
52    with the participation of experts practicing in the fields of palliative care, geriatrics and the ICU.  
53    ICU-stay at the EOL is an important outcome measure, since reducing the proportion of patients  
54    dying in the ICU means less use of uncomfortable or painful interventions and optimizing the  
55    family's ability to spend time with the dying patient. Second main outcome measure is the presence  
56    of a DNR order at the time of death on non-ICU wards, because these discussions represent a  
57    potential turning point in the goals of care away from cure to a more palliative care path. The  
58    quality of these DNR decisions is assessed by looking at the timing of the DNR decision (within 2  
59    days before death or not) and participation of patient and nurse in the decision.

### 60    **Design**

61 Data concerning EOL decisions were prospectively collected by a 12-week observational study in  
62 2007 and a 16-week period in 2008 of all consecutive in-hospital deaths > 16 years. Patients  
63 admitted on psychiatric wards, the palliative unit, day-hospital and the emergency room were  
64 excluded. In order to study the quality of EOL policy of physicians on non-ICU wards, special  
65 attention was paid to elderly adult hospitalised patients with somatic chronic diseases who were  
66 admitted 2 days or more on non-intensive wards in their final hospitalization in whom consequently  
67 ACP was possible (figure 1).

68 The investigators received daily information on a patient's death by the central administration of the  
69 hospital. Recall bias was minimized by approaching health care providers within 72 hours after the  
70 patient had deceased. Through questionnaires, physicians were asked patient data. Underlying  
71 pathologies were classified into three categories, namely no chronic illness, chronic illness and  
72 active malignancy (i.e. metastatic solid tumour or relapsing haematological malignancy requiring  
73 chemotherapy). The severity of these pathologies were compared between patients by using the  
74 Charlson comorbidity score, a widespread comorbidity index measuring long-term prognosis<sup>19,20</sup>.  
75 Nurses and physicians were asked to report the DNR code as well as the degree of participation of  
76 patient, family and nurse in the DNR decision. Head nurses reported admittance data and made the  
77 written DNR form anonymous. Overall, 94% of the physicians, 95% of the nurses and 93% of the  
78 head nurses returned the questionnaire after the patients died.

79 The protocol was approved by the ethics committee of the Ghent University Hospital. Every  
80 questionnaire included a letter which explained the goal of the study and emphasized that  
81 participation was not compulsory. In order to preserve anonymity of patients and health care  
82 providers, the questionnaires were collected by an independent person.

83 **Analysis**

84 Values were expressed as median (25<sup>th</sup>-75<sup>th</sup> percentile) or as number (percentage) when appropriate.  
85 Groups were compared by the Mann-Whitney U test for continuous variables, and by a Fisher's  
86 exact or Pearson Chi-Square test for categorical variables. A two-sided p-value of less than 0.05

was considered statistically significant. The software package SPSS 15.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis.

## RESULTS

In total, 330 adult patients died of whom 33% (n=103) were 75 years or older. The underlying comorbidities of deceased patients differed significantly between both age groups: 3% of older patients had no underlying disease, 70% non-malignant comorbidities and 27% had an active malignancy compared to respectively 11%, 56% and 33% of deceased patients younger than 75 years ( $p=0.014$ ). Patients  $\geq 75$  years were less frequently referred to the ICU in their final hospitalization compared to the younger group (42% versus 58%,  $p=0.008$ ) and their length of ICU-stay was shorter (median 3.0 (2-11) days versus 6.5 (2.5-16) days in the younger group,  $p=0.023$ ). However, there was no difference in frequency of DNR decisions at the moment of dying on non-ICU wards (87% (67/77) versus 88% (55/62),  $p=0.937$ ). Concerning timing and participation in these DNR decisions, there were no significant differences (table 1). 40% (25/62) of older patients were considered to be incompetent versus 25% (26/77) in patients younger than 75 years ( $p=0.042$ ). In both age groups, almost 90% of competent patients were informed about the DNR decision.

### Determinants of ICU referral in the older patient at EOL

Patients  $\geq 75$  years admitted on the acute geriatric ward less frequently died in the ICU (table 3) (4% (1/26) compared with 22% (10/46) of elderly patients referred from non-geriatric wards,  $p=0.048$ ) despite similar long term prognosis measured by the Charlson comorbidity score (table 2). In order to determine the importance of possible 'risk factors' for referral to the ICU at the EOL, a multivariate model was set up including age of the patient, active malignancy versus non-malignant chronic disease, long-term prognosis (Charlson comorbidity index) and coming from geriatric ward or not. Because of the pre-dominance of female patients on the geriatric ward (table 2), which could be possibly linked to comorbidity, gender was also included in the model. Multivariate analysis shows that age and severity of comorbidity were no significant risk factors for dying in the ICU

112 (figure 2). Being admitted to a geriatric ward and having malignant disease were associated with a  
113 lower risk of dying in the ICU (figure 2).

114



## 115 **DISCUSSION**

116 The objective of this study was to assess the quality of EOL policy in different age groups with  
117 special focus on determinants of risk of being referred to the ICU at the EOL in patients in whom  
118 ACP was possible.

### 119 **Old versus younger patients**

120 Older patients less frequently are referred to the ICU at the EOL than younger patients. One can  
121 wonder if this means that older patients are denied the option of life-sustaining treatments in favour  
122 of younger patients. Researchers from the SUPPORT study concluded that less aggressive treatment  
123 for older patients does not contribute to the modest survival disadvantage associated with older age  
124 <sup>21</sup>. On the other hand, other studies show that old age is in fact a reason for not admitting patients to  
125 the ICU because of prognostic reasons <sup>11,22</sup>. However, there is consensus that functional status and  
126 comorbidity are more important than age in determining the chance of ICU and hospital survival  
127 <sup>23,24,25,26</sup>.

128 In discussions concerning benefit of usage of life-sustaining therapies for the elderly, it is important  
129 not only to consider prognostic knowledge but also to consider the preferences of the patient.  
130 Somogyi and colleagues observed that 54% of very old patients received intensive care before they  
131 died whereas most of these patients had stated that they did not want aggressive care <sup>11</sup>. Older  
132 patients want to be involved in discussions concerning preferences for EOL care but physicians do  
133 not initiate these discussions <sup>27,28</sup>. These early discussions are not associated with higher rates of  
134 major depressive disorder or more worry <sup>17</sup>.

135 However, decisions to withdraw or withhold therapies frequently are taken too late in the discourse  
136 of the disease of the older patient <sup>29</sup>. As a consequence, the clinical situation of the patients  
137 sometimes does not allow communication. In this study, 40% of elderly patients was considered  
138 incompetent to be involved in DNR decisions (versus 25% in the younger group, p=0.042).

### 139 **Determinants of ICU referral at EOL**

140 In a recently published death certificate study it was shown that in the very old, EOL decisions were  
141 less frequently taken. However, after adjusting for underlying comorbidities, age group in se was  
142 not associated anymore with a lower proportion of EOL decisions. Whatever their age, patients  
143 dying from non-malignant disease less frequently died after a non-treatment decision than patients  
144 with cancer <sup>30</sup>. This difference in attitude towards goals of care depending on specialties, with more  
145 emphasis on palliation in patients with malignant diseases has already been described <sup>31,32,33,34</sup> and  
146 seems to be at least as important as the age of the patient. However, what is new in this study, is that  
147 despite a smaller proportion of malignant disease in an elderly hospitalized population on the acute  
148 geriatric ward, it seems that geriatricians are less aggressive in their treatment choice at the EOL  
149 compared to other specialties. Less aggressive care is associated with better quality of life of the  
150 patient and less burden on the family after their loved one died <sup>17</sup>. The benefitting role of the  
151 geriatrician in EOL care has recently been described to be important in the oncogeriatric patient  
152 <sup>12,13,14</sup>. Most probably, the more patient-oriented approach of geriatricians (versus the disease-  
153 oriented approach of other specialists) leads to a less aggressive care for the dying elderly patient <sup>14</sup>.

154 **Limitations and future studies**

155 A multicentre study design is needed to confirm if this observed difference in approach at the EOL  
156 can be generalized.

157 In the future, the effectiveness of initiatives to implement holistic values in daily patient care for  
158 elderly patients admitted on non-geriatric care wards should be studied.

159

160 In summary, older patients are less frequently referred to the ICU at the EOL. Not only prognostic  
161 factors but also the preferences for EOL care should be considered. It is problematic that elderly  
162 patients frequently are incompetent at the time decision-making is crucial. Earlier discussions  
163 concerning EOL preferences should be encouraged. Besides the difference in ICU referral between  
164 age groups, also patients with non-malignant diseases more frequently die a high-technological  
165 death compared to patients with cancer. However, it seems that after adjusting for age and severity

166 of underlying pathology, geriatricians treat their elderly patients at the EOL less aggressively than  
167 physicians on non-geriatric wards.  
168

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173    control for logistic support.

174    **Conflict of interest:** All authors have no conflicts of interest to disclose.

175    **Author's contributions:** All authors conceptualised and designed the study, developed the  
176    construction of the questionnaire and revised the manuscript critically. RDP collected and analysed  
177    the data and wrote the manuscript. RDP is the guarantor.

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## GRAPHICS

**Table 1. End-of-Life Quality Indicators in Patients who Died in the Hospital**

	All deaths		Patients dying on non-ICU*					
			No DNR†	Patients dying with DNR† form				
	Dying in ICU	ICU stay last episode	Dying without DNR form	Code 0 (full therapy) or code 1 (no CPR only)	First decision to limit therapy within 48 h before death	Information competent patient reported by physician	Information family of incompetent patient reported by physician	Participation nurse (involved)
< 75 years (n=211)	46%	58%	12%	3%	11%	88%	96%	60%
≥ 75 years (n=103)	31%	42%	13%	4%	15%	84%	100%	58%
p-value	0.012	0.008	0.937	0.880	0.520	0.599	0.999	0.808

\* ICU = Intensive Care Unit, † DNR = Do-Not-Resuscitate



**Table 2. Characteristics of Patients  $\geq 75$  years admitted on Geriatric vs. Non-Geriatric Wards**

	Non-G <sup>†</sup> wards (n=46)	G-ward <sup>†</sup> (n=26)	p-value
Age in years Median (IQR <sup>‡</sup> )	79.5 (77-85)	85 (83-87)	p<0.001
Sex (% male)	61%	39%	p=0.067
Median (IQR <sup>‡</sup> ) Total length of stay in days	15.5 (6-25)	9 (4-26)	p=0.485
Comorbidity			
- no comorbidity	4%	0%	p=0.020
- chronic disease(s)	53%	85%	
- active malignancy	44%	15%	
Seriousness of underlying disease			
- Median (IQR <sup>‡</sup> ) Charlson comorbidity index	3 (2-6)	3 (2-4)	p=0.698
- Median (IQR <sup>‡</sup> ) Combined with age score	6.5 (5-9)	7 (6-8)	p=0.486

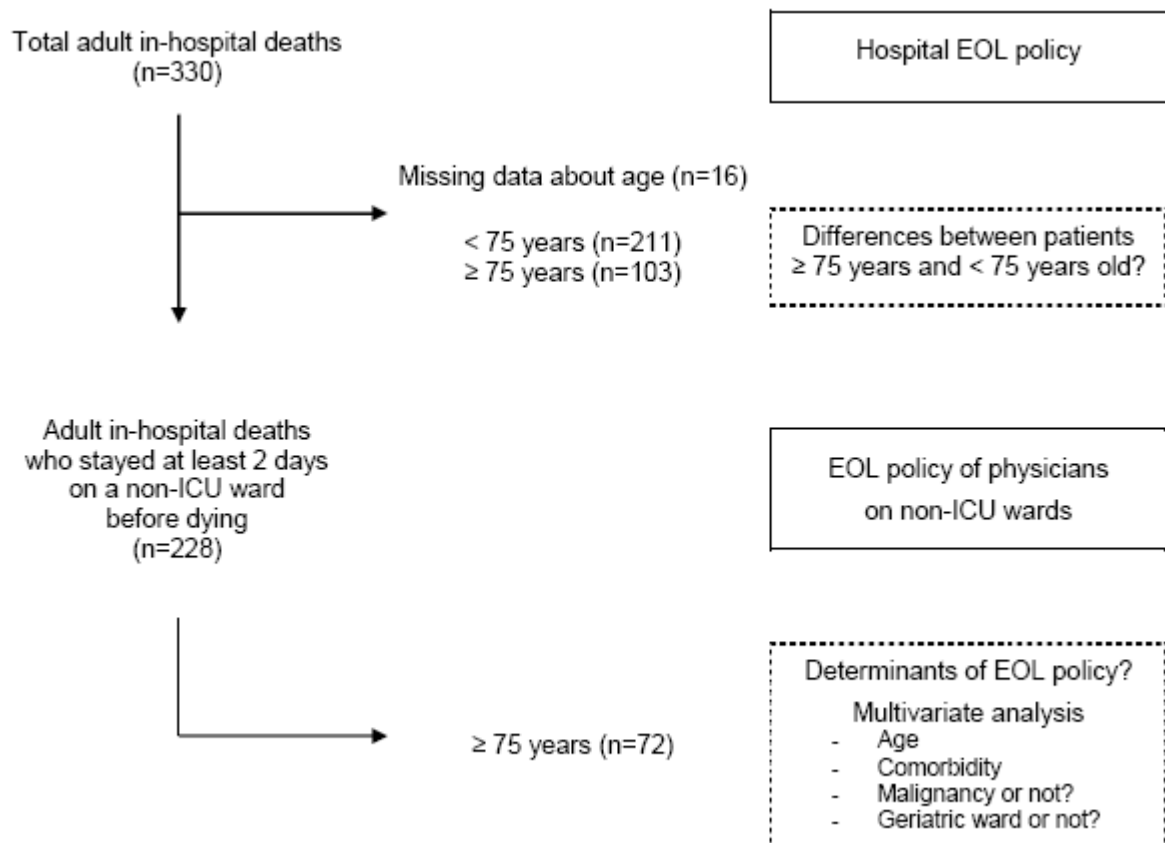
\*ICU = intensive care unit, <sup>†</sup>G = geriatric, <sup>‡</sup> IQR = interquartile range

**Table 3. End-of-Life Quality Indicators in Older Patients who Died in the Hospital**

	Patients dying on non-ICU*							
	All deaths		Patients dying with DNR† form					
			No DNR†					
	Dying in ICU	ICU stay last episode	Dying without DNR form	Code 0 (full therapy) or code 1 (no CPR only)	First decision to limit therapy within 48 h before death	Information competent patient reported by physician	Information family of incompetent patient reported by physician	Participation nurse (involved)
G‡-ward (n=26)	4%	19%	16%	5%	5%	75%	100%	60%
Non-G‡ wards (n=46)	22%	37%	6%	6%	0%	91%	100%	66%
p-value	0.048	0.117	0.216	0.999	0.432	0.319	0.999	0.682

\* ICU = Intensive Care Unit, † DNR = Do-Not-Resuscitate, ‡ G = geriatric

**Figure 1. Questions Examined in the Study and Methods**



**Figure 2. Multivariate Analysis: Patients Dying in the ICU versus on Non-ICU wards**

	B	S.E.	Wald	df	Sig.	Exp(B)	95,0% C.I. for EXP(B)	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Female gender	-,328	,304	1,158	1	,282	,721	,397	1,309
Active malignancy	-,952	,358	7,051	1	,008	,386	,191	,779
CharlsonCI (per point)	,014	,086	,029	1	,866	1,015	,857	1,201
Age (per year)	,003	,012	,084	1	,772	1,003	,980	1,027
Geriatric ward	-1,218	,538	5,125	1	,024	,296	,103	,849
Constant	,745	,919	,657	1	,418	2,106		